indicator, being changed either when a drop in performance is seen or using a calculated figure based on usage time under particular conditions. This can lead to early replacement of the bubbler when potentially another 10% of material in the bubbler could be used.

Clearly it would be desirable to provide an accurate probe for monitoring the level of organometallic precursor contained within a bubbler. However, problems arise with the provision of a suitable probe that has the necessary robustness and compatibility with the organometallic compounds with which it comes into contact. In this respect, the probe must not react with the chemicals contained within the vessel to ensure high purity metal deposits are achieved. Additionally, it should not impair the airtight seal of the bubbler since the contents are air-sensitive and the pressure within the vessel should be maintained.

It is an object of the present invention to provide a method of continuously monitoring the level of a reactive liquid in a vessel, particularly but not exclusively the level of a metalorganic compound, which aims to overcome, or at least alleviate, the abovementioned drawbacks.

A further object of the present invention is to provide an apparatus for continuously monitoring the level of a liquid in a vessel, particularly but not exclusively an metalorganic compound, that aims to overcome, or at least alleviate, the abovementioned drawbacks.

Accordingly a first aspect of the present invention provides a method for monitoring the level of a liquid in a vessel, the method comprising the steps of inserting at least one metallic probe into a vessel to act as a first electrode, hermetically sealing the probe within the vessel, providing a further electrode spaced

apart from the first electrode to form a capacitor, applying an electric current to the capacitor and monitoring the capacitance thereof.

A second aspect of the present invention provides an apparatus for monitoring the level of a liquid in a vessel, the apparatus comprising at least one metallic probe hermetically sealed within the vessel to act as a first electrode, a second electrode spaced apart from said first electrode to form a capacitor, means for applying an electric current to the capacitor and means for monitoring the capacitance thereof.

It is to be appreciated that the two spaced apart electrodes are provided in order to set up the necessary dielectric therebetween. The capacitance of the capacitor thus formed will vary with the amount of liquid between the probes thereby enabling the level of liquid within the vessel to be monitored.

Preferably the vessel itself is a metallic container, for example being of stainless steel, and acts as the second electrode. Alternatively, two parallel probes could be sealed within the apparatus to act as the first and second electrodes respectively.

The metallic probe that is inserted into the vessel may be in the form of a rod, a flat elongated plate or tube. The probe may be hollow or solid. Preferably the probe is made of stainless steel.

The probe according to the present invention is particularly suitable for use in monitoring levels of metalorganic compounds.

The probe is preferably attached to a port at the top of a vessel, the vessel generally being in the form of a bubbler, that contains an inlet and an outlet pipe. One end of the probe is preferably encased within a glass material and this is hermetically sealed within the port. More preferably, the probe is sealed within a mounting or cap

that is inserted into the port of the vessel. Preferably, the mounting is provided with electrical connections for the probe, for example in the form of a bayonet type connector, such as a BNC connector.

A coating, for example of an elastomeric material such as Teflon™, may be applied over at least a part of the probe that extends from the seal.

More preferably, at least the part of the probe that is encased in the glass material to form a metal to glass seal comprises a nickel alloy, more preferably being typically 70% nickel. More preferably, the alloy is made precipitation hardenable by the additions of aluminium and/or titanium thereto. Suitable alloys include those sold under the trade names Inconel X-750, Inconel 600 or Kovar. More preferably, an Inconel X-750 alloy is used. The glass that is sealed around this part of the probe is preferably a borosilicate glass. It is preferable for the probe to be sealed to the glass by such a matched seal.

The glass material may then be sealed within the mounting. The mounting is preferably comprised of a nickel alloy, such as Inconel X-750. The mounting preferably incorporates a gasket face seal fitting, such as a VCR profile at a connecting face and internal faces to suit the fit of an electrical connector and the glass-to-metal hermetic seal. The gasket is preferably one which is deformed on tightening to provide a secure metal-metal seal. The electrical connector is preferably surrounded by a layer of insulating material, such as a polyether ether ketone (PEEK).

Conventional means may be provided for applying an AC or DC source to the probe, together with monitoring means, such as a capacitance meter, for measuring a change in capacitance. Preferably, a recorder is also provided for recording the change in capacitance. The recorder may include display means, such as a liquid

crystal display. It is preferable for the capacitance to be continuously monitored thereby providing a continuous reading of the level of liquid in the vessel.

Preferably, the apparatus includes means for calibration of the system whereby a particular capacitance corresponds to a particular volume of liquid within the vessel. For example, the recording means could be set at a value of "0" for a capacitance recorded for an empty vessel and could be set "100" for the capacitance recorded for a full vessel. Preferably, the apparatus is calibrated to respond to particular characteristics of the liquid contained within the vessel. Additionally, the apparatus may be adapted to provide the rate of removal or addition of the liquid to the vessel.

In a preferred embodiment of the present invention there is provided a bubbler containing an metalorganic compound, the bubbler comprising a sealed metallic container having an inlet pipe, an outlet pipe and a dip-tube and further comprising a metallic probe hermetically sealed within the container, the container and the probe forming a capacitor, means for applying an electric current to the capacitor and monitoring means for measuring the capacitance thereof.

It is to be appreciated that the metallic probe may be hermetically sealed within the bubbler as hereinbefore described.

For a better understanding of the present invention and to show more clearly how it may be carried into effect reference will now be made to the following Examples in which Example 1 investigates the use of an apparatus according to one embodiment of the present invention in measuring the changing level of trimethylgallium (TMG) in a bubbler, Example 2 investigates the use of the same apparatus in measuring the changing level of trimethylaluminium (TMA) in a bubbler, Example 3 investigates the use of an apparatus according to another embodiment of

CLAIMS

1. An apparatus for monitoring the level of a liquid in a vessel (2), the apparatus comprising at least one metallic probe (10) hermetically sealed within the vessel to act as a first electrode, a second electrode spaced apart from said first electrode to form a capacitor, means (14) for applying an electric current to the capacitor and means for monitoring the capacitance thereof.

2. An apparatus as claimed in claim 1 wherein the vessel itself is a metallic container and acts as the second electrode.

3. An apparatus as claimed in claim 1 or claim 2 wherein the probe is made of stainless steel.

4. An apparatus as claimed in claim 1, claim 2 or claim 3 wherein one end (22) of the probe is encased within a glass material for sealing within the vessel.

5. An apparatus as claimed in claim 4 wherein the glass material is a borosilicate glass.

6. An apparatus as claimed in any one of claims 1 to 5 wherein the probe is hermetically sealed within a port provided at the top of the vessel.

7. An apparatus as claimed in claim 6 wherein the probe is sealed within a mounting or cap (30) that is inserted into the port of the vessel.

8. An apparatus as claimed in claim 7 wherein the mounting is provided with electrical connections for the probe.

9. An apparatus as claimed in any one of the preceding claims wherein the probe is provided with a coating of an elastomeric material over at least the part that extends from the seal.

10. An apparatus as claimed in any one of claims 4 to 9 wherein at least the part (22) of the probe that is encased within a glass material comprises a nickel alloy.

11. An apparatus as claimed in claim 10 wherein the alloy is an Inconel or Kovar alloy.

12. An apparatus as claimed in claim 10 or claim 11 wherein the alloy contains aluminium and/or titanium.

13. An apparatus as claimed in claim 12 wherein the alloy is Inconel X-750.

14. An apparatus as claimed in any one of claims 7 to 13 wherein the mounting (32) is made of a nickel alloy.

15. An apparatus as claimed in claim 14 wherein the alloy is Inconel X-750.

16. An apparatus as claimed in any one of the preceding claims further comprising monitoring means for measuring a change in capacitance.

17. An apparatus as claimed in claim 16 further comprising a recorder for recording a change in capacitance.

18. An apparatus as claimed in claim 17 further comprising display means for displaying the level of liquid in the vessel.

19. An apparatus as claimed in any one of the preceding claims further comprising calibration means for calibration of the apparatus whereby a particular capacitance corresponds to a particular volume of liquid within the vessel.

20. An apparatus as claimed in any one of the preceding claims for use in monitoring the level of organometallic compounds.

21. An apparatus as claimed in any one of the preceding claims wherein the container is a bubbler.

22. A bubbler containing an organometallic compound, the bubbler comprising a sealed metallic container having an inlet pipe (4), and outlet pipe (8) and a dip tube (6) and further comprising a metallic probe (10) hermetically sealed within the container, the container and the probe forming a capacitor, means for applying an electric current to the capacitor and monitoring means for measuring the capacitance thereof.

23. A method for monitoring the level of a liquid in a vessel, the method comprising the steps of inserting at least one metallic probe (10) into a vessel (2) to act as a first electrode, hermetically sealing the probe within the vessel, providing a further electrode to form a capacitor, applying an electric current to the capacitor and monitoring the capacitance thereof.